

THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY – LEVEL 03
CONTINUOUS ASSESSMENT TEST I -2012/2013
MPZ3231 – ENGINEERING MATHEMATICS IA
DURATION: ONE AND QUARTER $\left(1\frac{1}{4}\right)$ HOURS

Registration No:.....

Date 27thDecember 2012 Time 9:00a.m– 10:15 a.m.

Instructions:

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| <ul style="list-style-type: none">• Answer all the Questions.• Number of pages in the paper – 07.• All symbols are in standard notation. |
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01. (a) Define the *scalar product* and the *vector product* of two vectors. [20 marks]

(b) The vectors \overrightarrow{OA} , \overrightarrow{OB} , \overrightarrow{OC} are given by

$$\overrightarrow{OA} = 2\mu \mathbf{i} + 3\mathbf{j} + 2\mathbf{k}, \overrightarrow{OB} = \mu \mathbf{i} + (\mu - 1)\mathbf{j} + \mathbf{k}, \overrightarrow{OC} = 4\mathbf{i} + 2\mathbf{j} + 3\mathbf{k},$$

where μ is a scalar.

(i) Find the value of μ for such that \overrightarrow{OA} and \overrightarrow{OC} are perpendicular. [15 marks]

(ii) Find $(\overrightarrow{OA} \times \overrightarrow{OB}) \cdot \overrightarrow{OC}$

[30 marks]

(iii) Determine the values of μ such that the points O, A, B, C are coplanar.

[15 marks]

(iv) When $\mu = 2$, find the volume of the parallelepiped formed by the vectors

$\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{OC}$

[20 marks]

02. (a) Given that $A = \begin{bmatrix} 5 & 1 \\ 1 & 5 \end{bmatrix}$

(i) Find the matrix $-\lambda I$, where $\lambda \in \mathbb{R}$ and I is the 2×2 unit matrix.

[10 marks]

(ii) Prove that $\det(A - \lambda I) = \lambda^2 - 10\lambda + 24$.

[15 marks]

(iii) Find the eigenvalues of A .

[15 marks]

(iv) Prove that $A^2 - 10A + 24I = 0$, where 0 represents the 2×2 zero matrix.

[25 marks]

(v) Use (iv) to find A^{-1} .

[15 marks]

(b) Consider the following system of equations.

$$7x + 4y = 3$$

$$9x + 5y = 4$$

(i) Write down the above system in matrix form $AX = B$. [05 marks]

(ii) Using adjoint matrix of A , find A^{-1} and hence, solve the above system of equations.

[15 marks]

03. Consider the system

$$x + ay = 4$$

$$ax + 9y = b$$

(a) For which values of a does the system have a unique solution? [50 marks]

(b) Find those pairs of values (a, b) for which the system has more than one solution.

[50 marks]

END

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